

**A Guide To:
Reclamation Criteria for Wellsites and
Associated Facilities - 2007 - Forested Lands
In The Green Area Update**



May 2007

Overview

The purpose of this document is to provide guidance on reclamation certification criteria (Forested Lands in the Green Area) for oil and gas wellsites and access roads, and associated facilities such as borrow pits, campsites, and off-site (remote) sumps. Although many of the factors are relevant, it is not intended as a construction guide. This document should, however be considered when planning for oil and gas construction. This guide also applies to oil production sites, and will be in effect until revisions to the 1995 Reclamation Criteria for Wellsites and Associated Facilities have been completed and implemented. ****Please note: Bolded text-boxes in this document indicate documents or elements of an assessment that are required to qualify for reclamation certification.***

At the end of this document is Appendix: Proposed Sampling Design for Forested Criteria Assessment. It is a **proposed** Forested Land use assessment protocol. The procedures outlined in this protocol have not been field tested nor tested for statistical rigour. Further review and testing of this protocol will be conducted throughout 2007 to substantiate if these procedures best satisfy both the intended level of accuracy and the intent of this document. Other valid levels of assessments other than the proposed assessment attached in the appendix that provide the assurances required by the guideline will also be evaluated in requests for reclamation certification. In addition, any improvements or alternative assessment procedures developed by other sub-committees within the Reclamation Criteria Advisory Group in the future will be incorporated where appropriate.

1995 Forested Lands in the Green Area Criteria (Section 4.0) Revisited:

3.0 Top Soil Conservation and Reclamation:

Topsoil conservation and replacement in reclamation is key to providing nutrients for plant development and a foundation of re-establishing a functioning ecosystem. Although the 1995 Criteria do not require soil assessment for Forested Lands in the Green Area, there are requirements for conservation and replacement of surface soils.

"Reclamation Criteria for Wellsites and Associated Facilities – 1995 Update" states "...all surface soils must be salvaged and replaced on the site."

All topsoil must be salvaged. Topsoil is defined as the surface forest floor and all "A horizon" soil (LFH, Ah, Ahe and Ae). If the topsoil depth is less than 15 cm conservation must include the topsoil plus the B-horizon up to a total depth of 15cm unless the B-horizon is considered unsuitable (chemical or physical limitations).

A key principle in salvage and redistribution of topsoil is to not dilute and/or bury the nutrient-rich LFH and A horizons by over or under stripping. Where a thick Ae horizon exists (i.e. >15cm), the intent would be to not dilute the nutrient rich layers (LFH, Ah, Ahe) with the less nutrient rich Ae horizon. However, generally the Ae horizon has better soil physical qualities than the underlying B-horizon. Two lift stripping (LFH, Ah, and Ahe) and (Ae) would ensure all organic rich and texturally valuable topsoil is available for reclamation.

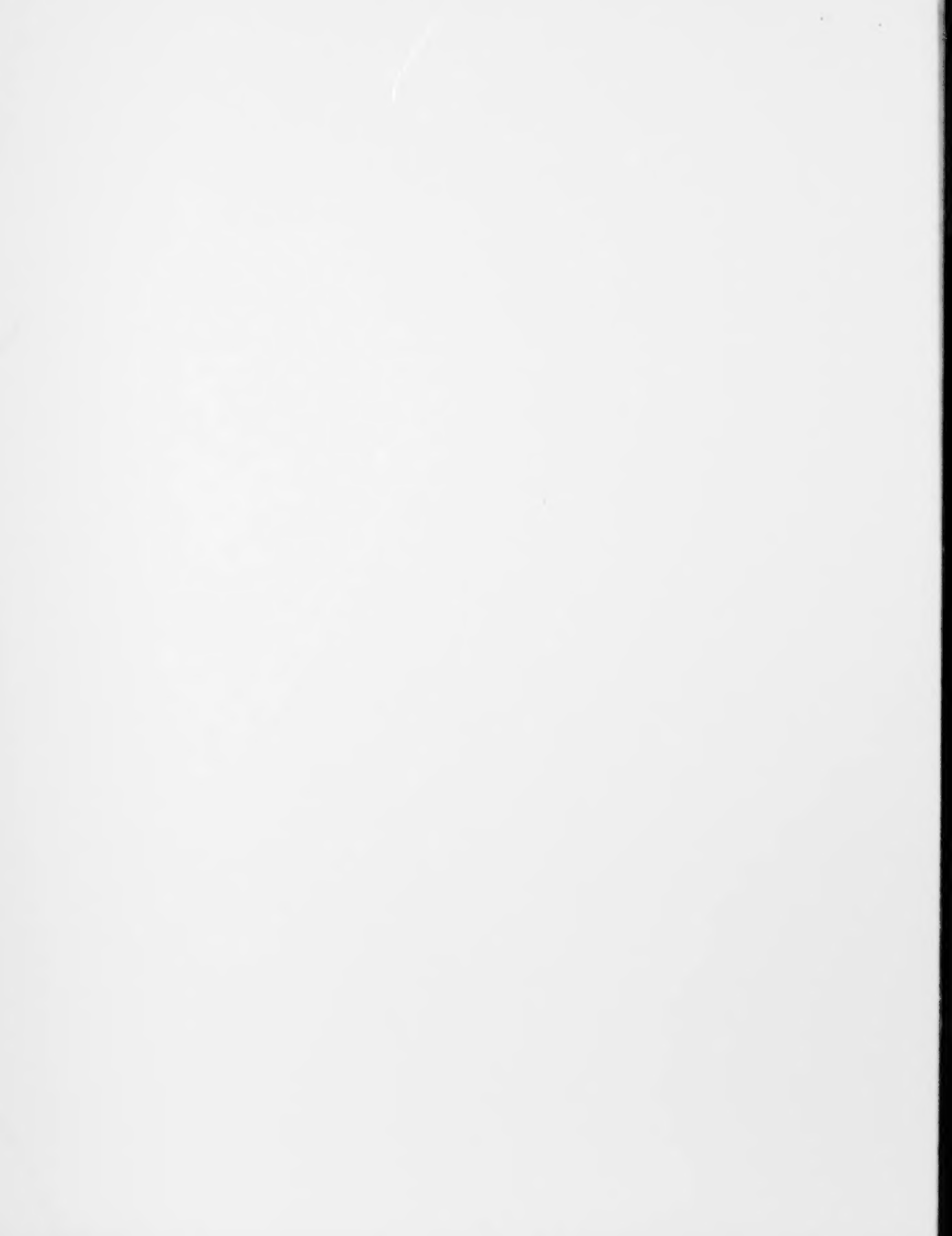
*** Assurances that topsoil has been conserved and redistributed satisfactorily is now required in order for a reclamation certificate to be issued.**

Where there has been no soil disturbance (stripping, compaction, etc), and it is documented, this assurance will not be required. This allowance does not apply to padded locations. **A proposed forested land sampling design follows in the Appendix.**

Padded Locations: Wellsites and any associated facilities that have not had the clay pad removed must comply with the following:

All pads left in place are considered a change in landuse and must be approved in writing by the landowner (ASRD). Receiving approval for pads to be left in place should be considered during the planning and Environmental Field Report (EFR) stage of site development.

- All accepted pads left in place based on documented change in land use must meet the soils expectations of this guide as well as any approved vegetative requirements.
- If a clay pad is to remain un-vegetated based on the documented change in land use (i.e. bale storage, pipeyard, etc) the site will not require soils or vegetation assessment but must be stable, non-hazardous and non-erosive.



Commonly Observed Indicators of Root, Permeability and Aeration Restrictions.

<p>Vertical Root Elongation Restriction Indicators</p> <ul style="list-style-type: none"> • Presence of root mats and bunches • Presence of flattened and highly branched roots • Presence of horizontal roots • Presence of exped roots • Presence of soil layers or abrupt texture or structure transitions • Absence of roots within or below reconstructed profile zones • Presence of dense and massive soil structure • Absence of roots within soil aggregates 	<p>Water Permeability Restriction Indicators</p> <ul style="list-style-type: none"> • Presence of surface ponding • Presence of surface vehicle (equipment) ruts • Presence of stratified or abrupt moisture changes within the soil profile • Presence of dense, massive or layered structure (compaction) • Presence of abrupt texture or structure transitions <p>Soil Aeration Restriction Indicators</p> <ul style="list-style-type: none"> • Presence of dense, massive or layered soil structure (compaction) • Presence of reduced pore size and pore space • Presence of distinct or prominent mottles • Presence of sour odours and/or grey-green soil colouration indicative of reduced conditions
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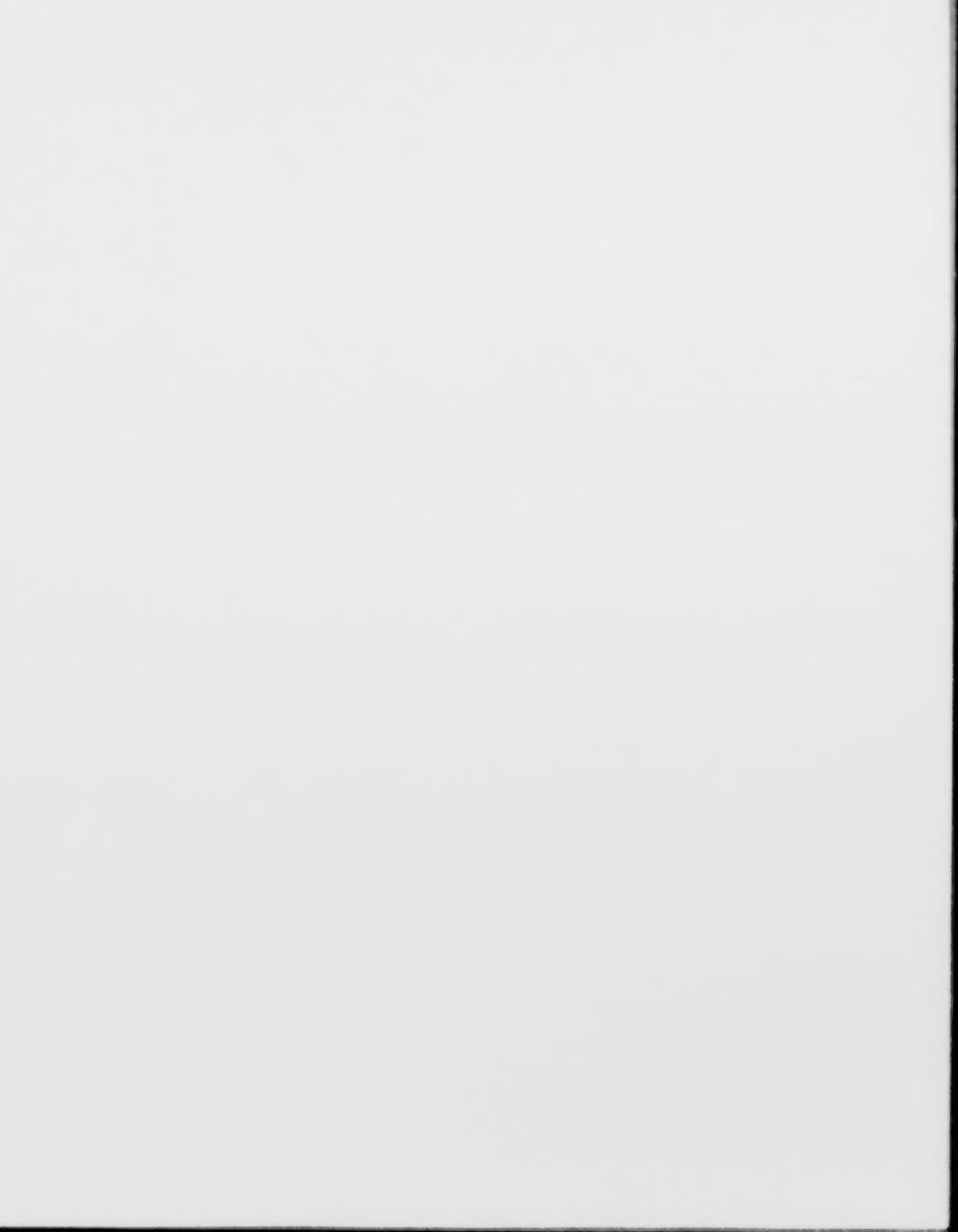
4.1 Surface water flow

On-site drainage: Standing water ("ponding") may be normal depending on pre-disturbance and surrounding landscape (i.e. knob and kettle topography) as well as timing of assessment relative to moisture events (snow melt or recent precipitation). Sites with significant soil compaction; those with sub-surface hard-pans; or those that have been poorly re-contoured often exhibit ponding. Other indicators of ponding include the presence of 'bathtub rings', water-loving vegetation types (either alive or recently dead), or lack of vegetation in depressions. Ponding is not necessarily evidence of poor reclamation.

*** The presence of on-site ponding must be noted and a rationale provided to show it is consistent with the site's normal state.**

Direction and dispersion of water on the lease will also help assess if surface drainage has been adequately restored. Ponding is one indication that a site's water direction and/or dispersion may have been disrupted. Another indicator of disrupted water direction and/or drainage is the presence of erosion on the lease. The use of pre-disturbance air-photos can help establish what "normal" direction and dispersion patterns should be.

*** Direction/dispersion of on-site drainage is assessed visually and confirmed during the assessment to be consistent with pre-disturbance conditions and/or surrounding landscape.**



of centimetres) does not constitute risks to a site's functioning and is therefore not considered as a negative characteristic.

*** Documentation of any rilling or pedestaling or presence of off-site soil 'fans' found on a reclaimed site is required. Also, evidence from adjacent areas or pre-disturbance should be included to demonstrate the scale and amount discovered is 'normal' for the area and that the lease is as stable as the surrounding area.**

Slumping/wasting: Mass movement of soil is not normally seen on most forested sites. If present, it would typically be evidence of inadequate reclamation. Where naturally unstable slopes are encountered, slumping/wasting may be considered normal.

*** Documentation of any slumping and/or wasting found on a reclaimed site is required. Evidence from adjacent areas or pre-disturbance should be included to demonstrate the scale and amount of slumping/wasting seen on-lease is considered normal for the area and that the lease is as stable as the surrounding area.**

Subsidence: The settling of soil in place is seen as a structural failure in the reclamation efforts and therefore is not normally allowed.

*** Documentation as to the degree and severity of subsidence must be included in the detailed site assessment and justification for acceptance provided.**

4.4 Landscape Operability

Contour - micro (small scale, on the order of cm): Minor variations in topography on reclaimed areas can often enhance conditions that will promote forest vegetation species recruitment, survival and growth. "Obstacle planting" is a common practice in forestry where tree seedlings are planted adjacent to large woody debris or rocks to enhance protection from excess wind or sun and/or to provide a vegetation-free space for plant development. Creation of small elevated sites (on soil ridges) can enhance localized drainage, and increase soil temperature to enhance root development. **Creation of a 'flat' lease during reclamation can often retard vegetation development and is undesirable.**

Contour – meso & macro (medium to large scale in the order of 10 to 100m): Ensuring that a reclaimed site's meso and macro contours integrate with the surrounding area is important in re-establishing surface water movement. It also helps prevent soil erosion and should be assessed with these factors.

Surface stoniness: Presence of naturally occurring stones within reclaimed areas is assumed to present no significant risks to ecosystem functioning, or normal forested land uses and can often aid in creating small scale roughness to enhance vegetation development. Where excessive



Prior to revegetation of reclaimed sites, the operator should contact the applicable Forest Management Agreement (FMA) holder (where applicable) and Alberta Sustainable Resource Development to discuss proposed revegetation plans. FMA holders have extensive local knowledge in soil, site and vegetation that may aid in cost effective and appropriate revegetation of leases.

The following clarify vegetation criteria expectations:

Plant Community/Diversity: Forest vegetation is characterized by the presence of a variety of species and plant sizes. A mixture of both woody and herbaceous species indicates development of forested conditions and can help prevent the dominance of a single species that might slow vegetation growth (i.e. heavy grass cover). A diverse plant community will also help re-establish nutrient cycling as well as support forest ecosystems and habitat.

*** The presence of a sub-set of woody and herbaceous species from target (control) forest types is required and a list of the species present on site must be included in the documentation.**

Natural Resources Canada published a series entitled "*Field Guide to Ecosites of.*", which provides species lists for mature forest types for Northern, West-Central and Southwest Alberta.

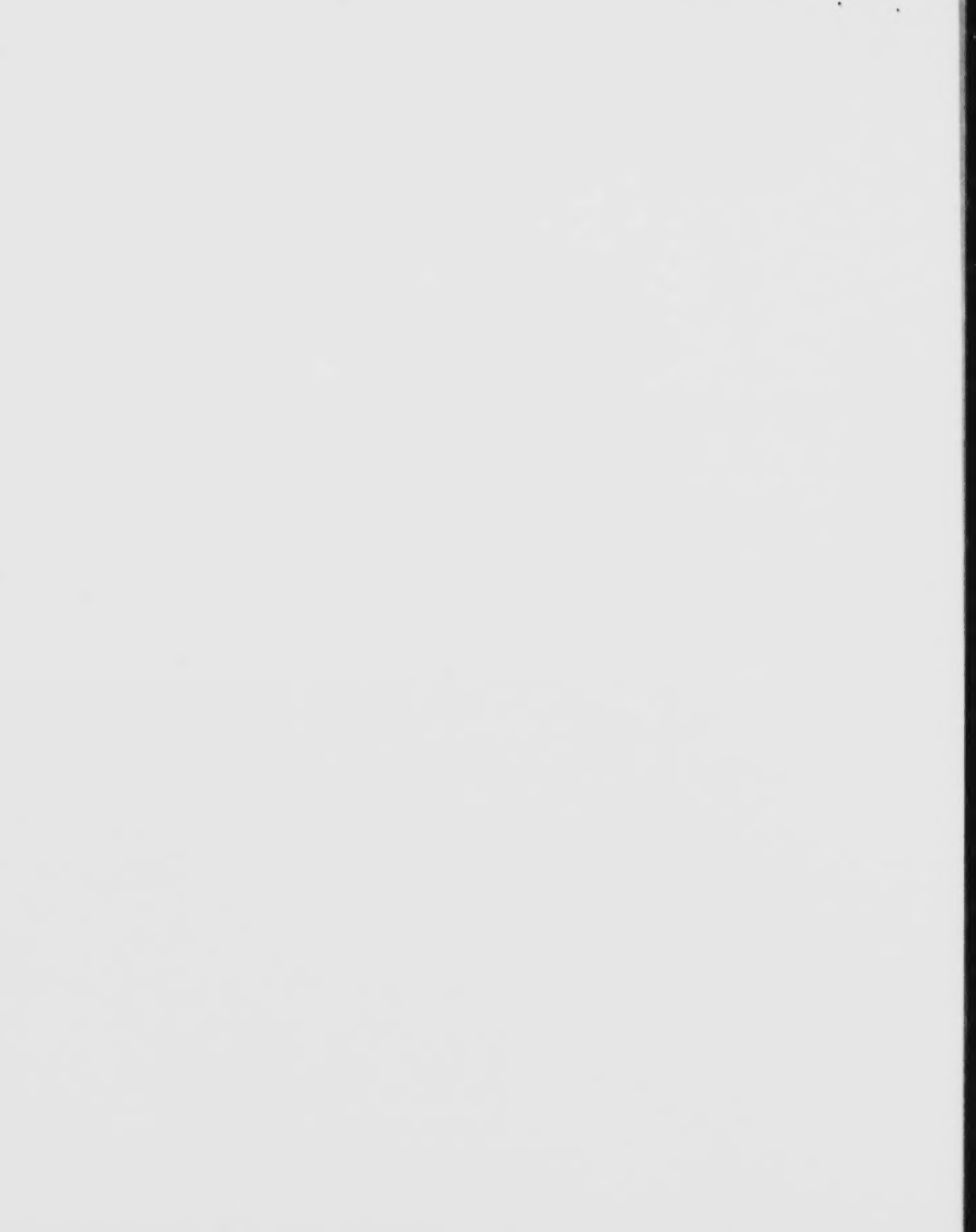
*** The presence of a community of native forest species is evidence of re-vegetation of species compatible with the target (original/control) forest type, as required in the 1995 Criteria.**

Structure; Layers: A properly reclaimed site should contain both the presence of herbaceous and woody species that are distributed across the site. Complete colonization of a site by herbaceous vegetation (i.e. grass) can preclude the recruitment of shrubs and/or trees due to the lack of appropriate micro-sites. Preventing aggressive herbaceous colonizers that could inhibit or preclude the recruitment and/or development of the target forest community is desirable. If provided space to establish, larger stature species (woody shrubs and tree seedlings) will eventually out-grow the herbaceous vegetation and reduce their extent on the site.

*** A minimum of two layers (herbaceous and woody) of vegetation compatible with the target (control) forest that is reasonably distributed over the lease is required to be present and must be documented.**

5.1 Vegetation Quantity

Historically, reclamation of forested lands has focused on the development of rapid vegetation growth (e.g. grass or forage) in order to satisfy the requirement for minimum cover, and to retard erosion. This guideline focuses on the use of appropriate species that provide cover and retard erosion but also help the recovery of the forest ecosystem. Where structural impediments to erosion (i.e. surface roughness, adequate vertical water flow) are in place, a greater variety of species can better facilitate the redevelopment of a forested plant community. The actual amount



the vegetation criteria. For example, use of agronomic annuals for early erosion control is an appropriate use of non-native species.

5.4 Vegetation Over-ride

The proposed changes to the *1995 Reclamation Criteria for Wellsites and Associated Facilities* are largely aimed at future development and ongoing reclamation. Historical practices may preclude the ability to meet some of these criteria on older sites. For old sites, where appropriate vegetation reestablishment is evident, criteria in this document may not be applicable. The concept of a vegetation over-ride has been carried over from the 1995 criteria document and its applicability to a particular lease must be approved in writing by the landowner (ASRD). Where reasonable forest cover (amount, species and distribution) is present, and where activities to meet the conditions described in this guideline may risk existing ecosystem functioning, a vegetation over-ride may be appropriate. Vegetation override criteria, however, must establish that equivalent capability for forested landscapes has been achieved.

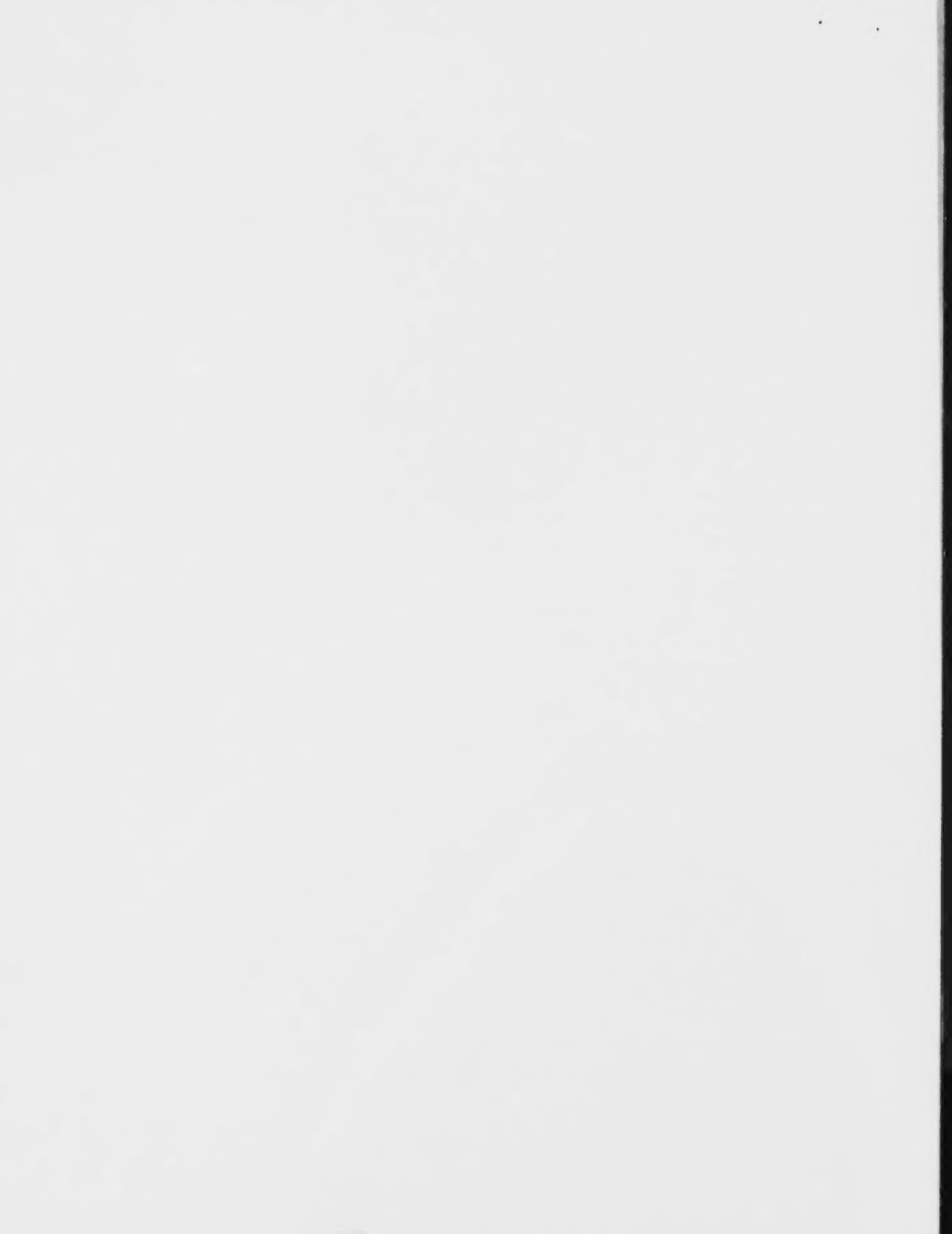
6.0 Assessment Locations and Protocol

For the purposes of this document, assessment locations detailed, cursory and controls (Appendix) consist of a localized area of 2 m diameter.

The procedures outlined in the proposed *Sampling Design for Forested Criteria Assessment* have not been field tested nor tested for statistical rigour. Further review and testing of this protocol will be conducted throughout 2007 to substantiate if these procedures best satisfy both the intended level of accuracy and the intent of this guideline.

7.0 Implementation

- A. Sites that have been constructed **after** the release of this guideline will be required to comply with all aspects outlined in this document.
- B. Sites that have been abandoned and/or reclaimed* **after** release of this guideline shall be assessed as follows:
 - Sites that were constructed after April 30, 1994 and prior to release of this document are expected to comply with all aspects of this guideline. Where extenuating conditions exist, topsoil justifications may be accommodated upon written request.
 - Sites constructed prior to April 30, 1994 are expected to comply with all landscape and vegetation components of this document and are encouraged but not required to comply with soil expectations.
- C. Sites abandoned and/or reclaimed* **prior** to release of this guideline shall be assessed as follows:
 - Sites constructed after April 30, 1994 are expected to comply with the soils and landscape components (extenuating soil situations may arise) and encouraged but not required to comply with the vegetation expectations.



Appendix

“Proposed” Sampling Design for Forested Criteria Assessment: 2007 Forested Lands in the Green Area Update

This is a **proposed** Forested Land use assessment protocol. The procedures outlined in this protocol have not been field tested nor tested for statistical rigour. Further review and testing of this protocol will be conducted throughout 2007 to substantiate if these procedures best satisfy both the intended level of accuracy and the intent of this document. Other valid levels of assessments other than this proposed assessment that provides the assurances required by the guideline will also be evaluated in requests for reclamation certification. In addition, any improvements or alternative assessment procedures developed by other sub-committees within the Reclamation Criteria Advisory Group in the future will be incorporated where appropriate.

A ‘risk-based’ sampling approach has been taken in the “Forested Lands in the Green Area” detailed site assessment requirements. The number of assessment points is limited and concentrated to the areas likely to have been subjected to the greatest impact. This approach assumes that if limiting factors at these heavily impacted points cannot be determined, there is a significantly less chance of these limitations occurring in other locations of the lease.

Two approaches have been developed to help balance cost and rigour of assessments (Figure 1). “Detailed” assessment points are strategically located where soil and detailed vegetation data are collected. Interspersed between these points, “cursory” assessment points are located where presence/absence data is collected but no detailed measures are conducted. The detailed points provide the basis for determining if limiting conditions exist, while the cursory points provide data to describe spatial distribution of characteristics.

Assessment locations are intended to be small localized areas (2m diameter) rather than point locations.

Plot layout:

Rectangular Leases:

With the exception of the well-centre and access road points, all other assessment locations should be systematically placed on a grid (30x30m) that samples across the entire lease area (Figure 1). Assessment points should be offset from the lease boundary by several metres to ensure the effective lease area is appropriately sampled.

The well-centre plot should be as close to the wellbore location as possible to assess the reclamation conditions at this heavily affected location. Similarly, the access road plot should be placed to assess conditions at the point where expected high levels of traffic impacts are likely to impact on the site.

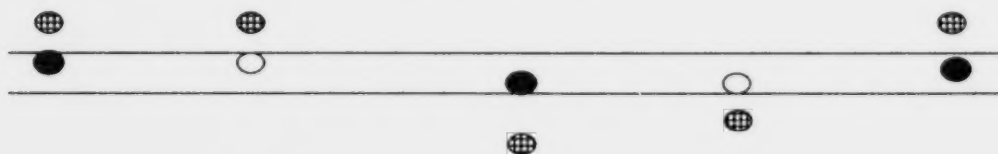
Cursory plots are to be located mid-way between each detailed plot. These plots serve as vegetative assessment and soil presence/absence locations only (see Figure 1).

A minimum of four control points should be located outside the lease boundary in areas that are representative of the pre-disturbance forest condition. Care must be taken to ensure that control points are appropriately representative. Use of aerial photography from pre-disturbance conditions, local knowledge of the site/area, and an understanding of site variability should be used to select these points. Generally, the four control points should be distributed evenly around the lease unless there is evidence that adjacent areas are of a differing condition than the lease area. Control points are meant to be in areas with minimal to no impact during lease activity. Where control points are placed differentially than on the four margins of the lease, a description of how and why the control points were selected must be included.

Linear Leases (roads):

Assessment of linear leases poses additional limitations in that the spatial distribution of both the control and on-site assessment points must address variability in site conditions. Use of assessment points randomly located within the lease width and periodically along the lease length can compensate for the anticipated variability. On-site and off-site plots should be paired (to control variability) and plot location should be placed to ensure the plot is entirely within either the disturbed or control areas. For access roads of less than 400m, location of detailed plots within the lease should be every 100m and cursory plots every 50 m (Figure 2).

Figure 2. Plot location on linear leases (<400m length)



For access roads of greater than 400m, it is proposed that an assessment scheme recognizing distinctly different units: i.e. topographic, vegetation and/or soils variability (as per the AENV "2001 Draft Reclamation Assessment Criteria for Pipelines") be used (Figure 3). Under this scenario differing map units must be identified within the assessment document. The minimum

- Cover estimates of each of the three dominant herbaceous species together with a total herbaceous species cover estimate is to be taken. A total per cent cover of all woody species combined is also to be recorded (shrubs only). The number of tree seedlings present by genus is also to be recorded.
- Tree growth indicators of leader increment for the past two years (length of the current and past year's terminal growth using bud scale scars) should be documented/assessed. Assess and document the occurrence and extent of browse if it occurs. Woody shrub's average current years branch growth (using budscale scars) are to be recorded on the dominant species present on each plot.
- Visual indication of poor health (chlorosis or very limited amount of foliage) should also be noted.

Landscape Characteristics: Landscape parameters, surface and sub-surface water flow, erosion, and landscape operability are to be assessed by examining the site as a whole. Documentation of the presence or absence of these parameters must be included in the assessment report.

Cursory (visual) Plot Assessments:

Soils: The presence or absence of topsoil is to be recorded at each cursory plot. No other soil measurements are required individual cursory plots unless the assessor suspects poor soil conditions and requires documentation of the conditions at a cursory plot location. *If soils have not been disturbed (stripping, compaction, etc) soil assessment will not be required. This does not apply to padded locations.*

Vegetation: Three vegetation variables are to be recorded for each cursory plot:

1. The presence or absence of herbaceous vegetation
2. The presence or absence of woody vegetation
3. The number of tree seedlings found

